VEGETABLE CROPS HOTLINE

A newsletter for commercial vegetable growers prepared by the Purdue University Cooperative Extension Service

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In This Issue

Opportunities for Growing Grafted Watermelons

(Wenjing Guan, guan40@purdue.edu, (812) 886-0198)

Watermelon production is threatened by Fusarium wilt, a widely distributed soilborne disease that can cause yield losses up to 100%. Currently, there are no watermelon varieties that are completely resistant to all races of Fusarium wilt. One way to control the disease is through grafting. The grafted plant combines a watermelon cultivar with a squash rootstock that has resistance to Fusarium wilt. In a study conducted at Southwest Purdue Ag Center (SWPAC), we found grafted watermelons significantly reduced disease incidence, and more than doubled watermelon yield in a Fusarium wilt infected field (Figure 1).

Figure 1. Grafted Fascination plants were grown on the right bed, ungrafted plants were grown on the left bed. The field was naturally infested with Fusarium wilt.

In addition to controlling Fusarium wilt, grafted watermelons often show substantial advantages in early watermelon production due to cold tolerance from rootstocks. In a study conducted in Arizona, grafted watermelons that were transplanted in the field two months before soil temperatures reached 70 °F had twice as much yield as ungrafted watermelons grown in the same condition. At SWPAC, we also observed that grafted watermelons had a greater transplant establishment rate, and grew faster in the early season compared to ungrafted seedlings when they were grown under low soil temperature conditions.

Although grafted plants are highly effective in controlling Fusarium wilt and offer advantages in early season production, acceptance of this practice among watermelon growers is low in the U.S. This is primary because grafted transplants are 3-4 times more expensive than ungrafted watermelon seedlings. It is estimated that growing grafted watermelons can increase transplant cost more than $1,000 per acre. The increased cost was more than double the cost of soil fumigation, which growers often rely on to control Fusarium wilt.

One way to mitigate the transplant cost of grafted watermelons is through reduced plant populations since grafted plants are more vigorous than ungrafted plants. It has been estimated that growing grafted plants might reduce plant populations by 20-30% while achieving a similar yield per acre. But the assumption has not been approved yet. There are studies which show that grafted watermelons are sensitive to excessive nitrogen, and too much nitrogen early in the growing season may lead to flower abortion. To test those assumptions, we will evaluate the performance of grafted watermelons with reduced plant populations and a well-defined fertility management program in the upcoming season. Results from the trial will be reported in the latter issues of *Vegetable Crops Hotline Newsletter*.

MELCAST 2017

(Dan Egel, egel@purdue.edu, (812) 886-0198)

Many cantaloupe and watermelon growers have transplanted seedlings to the field. Soon, these growers will have questions about what and when to apply fungicides. The article below in this issue of the *Vegetable Crops Hotline* will address what fungicides to apply (Fungicides schedules for cucurbits). This article discusses when to apply fungicides with the **MELCAST** system.

MELCAST (MELon disease foreCASTer) is a weather-based disease-forecasting program for cantaloupe and watermelon growers developed By Dr. Rick Latin at Purdue University. Instead of using a calendar based fungicide application program where one applies fungicides every 7 to 14 days, the **MELCAST** program lets growers apply fungicides when the weather is most conducive

to disease. The diseases for which **MELCAST** may be used for are: Alternaria leaf blight, anthracnose and gummy stem blight. Details are listed below or in the extension bulletin, Foliar Disease Control Using **MELCAST**, BP-67-W. Download the bulletin at http://www.extension.purdue. edu/extmedia/BP/BP-67-W.pdf or contact Dan Egel for a copy. The **MELCAST** program uses weather information from one of the 13 sites located around Indiana: Battleground, Daviess County, Decker, Elkhart County, Gibson County, Jackson County, Oaktown, Richmond, Rockville, Sullivan, SW Purdue Ag Center, Vincennes, and Wanatah. Cantaloupe and watermelon growers who want to use **MELCAST** should farm within about 50 miles of a **MELCAST** site. Cantaloupe and watermelon growers using **MELCAST** apply foliar fungicides every 14 days unless the weather thresholds described below indicate that an application should be made sooner. Below find more details.

1. Apply the initial fungicide application at or before vines touch within a row.
2. Check the Environmental Favorability (EFI) value for the day of fungicide application.
3. Calculate the threshold for the next application by adding 20 (cantaloupe) or 35 (watermelon) to the EFI value in step 2. To get a MELCAST calendar to keep track of EFI values, call Dan Egel. Alternatively, a **MELCAST** spreadsheet can be downloaded from http://melcast.info.
4. Apply the next fungicide application 14 days after the first, or sooner if the EFI threshold has been reached.
5. Check the EFI values on the day you make your next fungicide application and re-calculate the threshold for the next application.

A few things to remember: It is best to apply fungicides before the threshold has been reached rather than wait until after the threshold has been exceeded. So, for example, if you are a watermelon grower, the EFI threshold has reached 33 and a rain is expected soon, then go ahead and apply a fungicide. Use the thresholds of 20 and 35 EFI values as guides. Use a lower threshold if you feel that disease pressure is high. Finally, note that fungicide applications for downy mildew and powdery mildew cannot be scheduled with **MELCAST**.

Keeping track of **MELCAST** values is similar to keeping track of oil changes in a car or truck. When one changes oil, the mileage is written down and the oil is changed again at the next threshold (3,000 miles or 35 EFI values). EFI values, like mileage of a truck, continue to increase. Check EFI values by using the toll-free phone number 800-939-1604 Monday though Friday; check the website 7 days a week http://melcast.info and/or sign up for the free **MELCAST** Update that comes once a week during the season. Please call Dan Egel with any questions.

Cucurbit Fungicide Schedules

(Dan Egel, egel@purdue.edu, (812) 886-0198)

Cantaloupe, watermelon and pumpkin growers can use information in the *Midwest Vegetable Production Guide for Commercial Growers* (ID-56) to help determine what fungicides to apply. The **MELCAST** system (see accompanying article in this issue) can be used to help to decide when fungicides should be applied. I have developed two fungicide schedules that I hope will help growers determine the sequence of fungicides. One fungicide schedule is for cantaloupe and watermelon growers and the other one is for pumpkin growers.

Growers who are interested in obtaining a copy of these fungicide schedules should contact Dan Egel using either the email or the phone number listed above. I look forward to getting feedback about the usefulness of these schedules.

Video—Installing High Tunnel Insect Exclusion Screen

(Laura Ingwell, lingwell@purdue.edu)

One of the most damaging pests in cucurbit production are cucumber beetles and the bacterial pathogen they transmit (*Erwinia trachephila*), leading to bacterial wilt. In the recently released video, Dr. Laura Ingwell from Purdue Entomology demonstrates how to install insect exclusion screens on high tunnels. Such screens are effective at excluding cucumber beetles and the pathogen they transmit from high tunnels. The video can be viewed at: https://youtu.be/U1BYxOXc-RM

Taking Care of Plant Nutrition in Your High Tunnel – Water Hardness and the Removal of Unwanted Ions

(Petrus Langenhoven, plangenh@purdue.edu, (765) 496-7955)

It is essential, especially in hydroponics to start with a laboratory analysis of your source water. It is also important to do follow-up analysis throughout the year. Water quality can change especially where the water source is a well or a pond. In the article *Taking Care of Plant Nutrition in Your High Tunnel-Water Alkalinity* (Issue 627), we have discussed the importance of water alkalinity and how to correct high alkalinity levels. Additional elements of importance are Ca, Mg, S, Na, Cl, Fe and Mn. Knowing concentrations of these ions can help you to determine the need to purify water, leach or bleed more frequently, as well as to avoid these contaminants by choosing the appropriate fertilizer.

Hard water might be generally associated with high alkalinity, but it is not always the case. Water hardness is a measure of the amount of dissolved calcium (Ca) and magnesium (Mg), expressed as if it were calcium carbonate ($CaCO_3$). Hard water contains high amounts of dissolved Ca and/or Mg and the upper limit for high quality greenhouse irrigation water is 150 ppm $CaCO_3$ (Table 1). When the hardness is greater than 150 ppm, it is

important to check the amount of dissolved Ca and Mg in the water and determine the Ca:Mg ratio. The ratio should be 3 to 5 ppm Ca to 1 ppm Mg. If the ratio is higher, Ca can prevent or block the uptake of Mg. Conversely, if the ratio is lower Mg can block the uptake of Ca. The most common problem is a low level of Mg relative to Ca. This problem can be corrected with the addition of $MgSO_4$ (Epsom salt). Hardness at levels above 150 ppm could result in equipment clogging and foliar staining (deposits of scale) problems. Some types of water softening equipment replace the Ca or Mg in the water with sodium (Na). These treatment options make the water unsuitable for use in high tunnel and greenhouse production systems. Softening of water for greenhouse use is not recommended unless the process is followed by reverse osmosis treatment.

Table 1: Targeted range for high quality greenhouse irrigation water

Parameter	Target range (ppm)
Hardness	100-150
Calcium	40-120
Magnesium	7-24
Iron	<5
Manganese	0.2-0.7
Sulfate	24-240
Sulfur	<100
Sodium	<50
Cholride	<70

The **sodium** (Na) and **chloride** (Cl) concentration in the water should be less than 50 and 70 ppm, respectively. Sodium can interfere with the uptake of Ca and Mg, and can cause foliar burns due to poor water uptake and Na accumulation in plant tissue. The Sodium Absorption Ratio (SAR) indicates the relative concentration of Na to Ca and Mg in water. SAR greater than 4 could result in root uptake of toxic levels of Na. High Na and Cl levels are a much bigger problem in coastal areas. If you do experience excessive levels of Na and Cl dilute the water with rain water or any other source that has lower Na and Cl levels. Reverse osmosis or distillation treatment of the water is also recommended in very bad cases. It will be advantageous to irrigate larger water volumes at a time to ensure leaching of salts from the soilless substrate. When producing in soil you may also want to uncover your high tunnel during the winter in order for the snow and rain to leach the excess salts from the soil.

Iron (Fe) and **Manganese (Mn)** is soluble in their reduced states (Fe^{2+} and Mn^{2+}). High levels of soluble ferrous iron and manganese may be found in well water. When oxidized, Fe^{3+} precipitate as an insoluble red substance and Mn^{2+} precipitates as MnO_2. When water containing high Fe and Mn concentrations are used for drip irrigation, the ions are oxidized and these insoluble salts will block drippers. Apart from oxidization due to aeration, chemotrophic ferric and manganese bacteria can also contribute to the oxidization of Fe and Mn. These bacteria cause the oxidized residues to accumulate among the bacterial waste, creating a slimy residue that blocks drippers. Specialized equipment can be purchased for iron removal. After oxidation it can be filtered out through a resin bed. Large-scale removal is most efficient using a settling pond and a sand media filter. Various oxidizing filters can also be used depending on other water chemistry. Removal of manganese utilizes the same treatment described for iron, but removal is more difficult and may require additional pH adjustment (Table 2). Characteristics of water quality in terms of risk of blocking drippers are listed in Table 3.

Table 2: Aerobic oxidation time as affected by pH

pH level	Aerobic oxidation time for Fe (minutes)	Aerobic oxidation time for Mn (minutes)
<6.0	> 180	> 1000
6.6	< 60	> 1000
7.2	< 10	> 1000
7.8	< 6.6	> 1000
9.0	< 3	< 200
9.5	< 2	< 45

Table 3: Water classification indicating relative clogging potential in drip irrigation systems

Clogging Hazard	Maximum Fe (ppm)	Maximum Mn (ppm)	Maximum hydrogen sulfide (ppm)
pH	<7.0	7.0 – 8.0	>8.0
Minor	<0.2	<0.1	<0.5
Moderate	0.2 – 1.5	0.0 – 1.5	0.5 – 2.0
Severe	>1.5	>1.5	>2.0
1. Bicarbonate concentrations exceeding about 2 meq/liter and pH exceeding about 7.5 can cause calcium carbonate precipitation. 2. Calcium concentrations exceeding 2–3 meq/liter can cause precipitates to form during injection of some phosphate fertilizers. 3. High concentrations of sulfide ions can cause iron and manganese precipitation. Iron and manganese sulfides are insoluble, even in acid solutions.			

Source: Circular 573. New Mexico State University

Sulfur and **hydrogen sulfide** is rarely a parameter of concern in Indiana. Sometimes sulfate in well water converts to hydrogen sulfide. Hydrogen sulfide occurs in concentrations of less than 10 ppm, but can be as high as 50 – 75 ppm. Its commonly found in ground water, especially where wells are drilled in shale or sandstone, or near coalfields. Much of the groundwater in northwestern and northeastern Indiana has noticeable levels of hydrogen sulfide . High levels of hydrogen sulfide occurs in smaller sections of the state. The biggest threat to agriculture is the possible clogging of drip irrigation emitters. Sulfide can precipitate to clog emitter flow passages. Precipitation problems will generally not occur when hard water, which contains large amounts of hydrogen sulfide, is used. Hydrogen sulfide will minimize the precipitation of calcium carbonate ($CaCO_3$) because of its acidity. Several removal techniques can be considered. The

same iron and manganese removal filter can be used to remove low to moderate amounts of hydrogen sulfide. The filter oxidizes the hydrogen sulfide, converting it to insoluble sulfur, which are removed through the filtering process. An activated carbon filter can also be used to remove sulfur sediment (Extension bulletin WQ-11, Purdue University).

This is the second article in a 7 part series that look at soil fertility and nutrient solution management for high tunnels. In the next issue, we will concentrate on 'Water Soluble Fertilizer Calculations'.

Upcoming Events

Southwest Purdue Ag Center Field Day

Southwest Purdue Ag Center Field Day will be held on June 29, 2017 at Southwest Purdue Agricultural Center, Vincennes, IN.

The field day provides two choices of tours: Horticultural Crop Production and Agronomic Crop Production. The Horticultural Crop Production tour will feature Organic Tomato Production, High Tunnel Vegetable Production, Grape Research, Protecting Pollinators while Managing Insect Pests in Watermelon Production, and Produce Food Safety. A meal will accompany the tour with PARP classes available after lunch. Please contact Barb Joyner (joynerb@purdue.edu, 812-886-0198) for registration, or register online at https://purdue.qualtrics.com/jfe/form/SV_0rICQrMVJmiMnqZ. More information about the tour can be found here.

Beginning Farmer Tours and Workshops

Join Purdue's beginning farmer team for farm tours in 2017.

June 15. Clay Bottom Farm near Goshen, IN uses intensive growing methods to support a CSA program on less than an acre of land. Learn about their 'lean farm" approach to support a CSA, supply restaurants, and sell at farmers' markets.

June 24. Silverthorn Farm near Rossville, IN uses organic practices to produce a wide variety of fruits and vegetables. The tour will include a session on working with restaurants.

September 11. Two tours for the price of one! Tour Little Prairie Farms, a small acreage vegetable farm near Brookston, IN, and the Purdue Student Farm near West Lafayette to learn about farming practices and tools for small acreage farms.

September 27. Full Hand Farm is a diverse vegetable farm located near Noblesville, IN. The tour will include information on the use of high tunnels in vegetable production.

October 2. Aficionado Farms produces organically grown produce, herbs, and flowers near Elberfeld, IN. Learn about their farm and Farm to School programs.

More information about these tours are available at http://www.cvent.com/events/beginning-farmer-tours-and-workshops/event-summary-0f7526f0380a432788708b2f2edcf1e7.aspx

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